



**Final Technical Memorandum for
Miscellaneous Surplus OU Study Areas
Fort Sheridan, Illinois**

19980603 030

November 7, 1997

DTIC QUALITY INSPECTED 1

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| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE November 7, 1997 | 3. REPORT TYPE AND DATES COVERED Decision Document 3/97-11/97 | | |
| 4. TITLE AND SUBTITLE Final Technical Memorandum for Miscellaneous Surplus OU Study Areas, Fort Sheridan, Illinois | | 5. FUNDING NUMBERS DAAA15-90-D-0017 Delivery Order 0002 | | |
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| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) QST Environmental Inc. 11665 Lilburn Park Road St. Louis, Missouri 63146 | | 8. PERFORMING ORGANIZATION REPORT NUMBER 490-2087-0115 | | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Environmental Center Base Closure Division Attn: SFIM-AEC-BCA Edgewood Area Building E-4480 Aberdeen Proving Ground, Maryland 21010-5401 | | 10. SPONSORING/MONITORING AGENCY REPORT NUMBER SFIM-AEC-ER-CR-97065 | | |
| 11. SUPPLEMENTARY NOTES | | | | |
| 12a. DISTRIBUTION/AVAILABILITY STATEMENT Distribution unlimited. Approved for public release. | | | 12b. DISTRIBUTION CODE | |
| 13. ABSTRACT (Maximum 200 words) The results of Final Sampling Results and Data Evaluation for Miscellaneous Surplus OU Study Areas Report (Miscellaneous Study Areas DER) indicate that many study areas have estimated cumulative relative carcinogenic risk values exceeding the 1E-06 screening criteria and/or an estimated cumulative relative noncarcinogenic hazard index (HI) exceeding 1. These exceedences are an indication, not a confirmation, that these study areas may pose a potential unacceptable risk to human health. The Technical Memorandum further evaluates, for each study area, those constituents that exceeded the risk-based screening criteria in order to make a risk management decision regarding the disposition of the study areas. The Technical Memorandum formulates a determination as to whether or not further environmental evaluation and/or remediation is necessary prior to surplussing each of the study areas. | | | | |
| 14. SUBJECT TERMS Fort Sheridan, Miscellaneous Study Areas, Surplus OU, Decision Document | | | 15. NUMBER OF PAGES 25 | |
| | | | 16. PRICE CODE | |
| 17. SECURITY CLASSIFICATION OF REPORT Unclassified | 18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified | 19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified | 20. LIMITATION OF ABSTRACT UL | |

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List of Acronyms

| | |
|------------------|---|
| B912 | Building 912 |
| BCT | BRAC Cleanup Team |
| BRAC | Base Realignment and Closure |
| CFR | Code of Federal Regulations |
| CSA | Coal Storage Area |
| FY | Fiscal Year |
| HI | hazard index |
| IAC | Illinois Administrative Code |
| IEPA | Illinois Environmental Protection Agency |
| LCFPD | Lake County Forest Preserve District |
| mg/kg | milligram per kilogram |
| PAH | polynuclear aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| PRG | preliminary remediation goal |
| RS _c | cumulative carcinogenic relative risk value |
| RS _{nc} | cumulative non-carcinogenic relative risk value |
| RS _c | relative individual carcinogenic risk |
| RS _{nc} | relative individual non-carcinogenic risk |
| SSL | soil screening level |
| TACO | Tiered Approach to Cleanup Objectives |
| TEP | Technical Evaluation Plan |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TM | technical memorandum |
| USEPA | U.S. Environmental Protection Agency |
| UCL | upper concentrations limit |
| UXO | unexploded ordnance |
| VES | Vehicle and Equipment Storage |

1.0 Statement of Basis and Purpose

The results of Section 6.0 of the Draft Final Sampling Results and Data Evaluation for Miscellaneous Surplus OU Study Areas Report (Miscellaneous Study Areas DER) indicate that many study areas have estimated cumulative relative carcinogenic risk values exceeding the 1E-06 screening criteria and/or an estimated cumulative relative noncarcinogenic hazard index (HI) exceeding 1. The screening process in Section 6.0 is based on generic, conservative risk-based screening values. Thus, these exceedences are an indication, not a confirmation, that these study areas may pose a potential unacceptable risk to human health.

This Technical Memorandum (TM) further evaluates, for each study area, those constituents that exceeded the risk-based screening criteria in order to make a risk management decision regarding the disposition of the study areas. Therefore, for study areas where the cumulative carcinogenic risk to an individual for both current and future land use falls within the 1E-04 to 1E-06 risk range, this TM formulates a determination as to whether or not further environmental evaluation and/or remediation is necessary.

As indicated in the Miscellaneous Study Areas DER, those study areas with constituents detected below the risk-based screening values are not evaluated further. These study areas are the Former NIKE Site Control Area [Building 912 (B912)] and Former Ammunition Magazines. Because these study areas did not have detected constituents exceeding the risk-based screening, they do not pose an unacceptable risk to human health or the environment and can be surplussed without further environmental evaluation or remediation.

2.0 Study Area Evaluation

Each of the Miscellaneous Surplus OU study areas is individually evaluated in the following paragraphs. The conclusions and/or recommendations reached for each study area also took into consideration the ecological evaluation conducted in Chapter 7.0 of the Miscellaneous Study Areas DER. The conclusion of the ecological risk screening is that none of the study areas present a significant risk to ecological receptors. The evaluation presented below focuses on those constituents in each of the individual study areas that contribute at least 80 percent of the total relative carcinogenic and noncarcinogenic risks (i.e., the risk "drivers"). Each of the individual constituents contributing to the total relative carcinogenic and noncarcinogenic risks are presented and discussed in the Miscellaneous Study Areas DER.

2.1 Disturbed Area

The results of the risk-based screening for the Disturbed Area are a cumulative carcinogenic relative risk value (RS_{ca}) of $2E-04$ and a cumulative noncarcinogenic risk value (RS_{nc}) of 10. The principal component of the RS_{ca} is arsenic with a relative individual carcinogenic risk (RS_{ci}) of $2E-04$ (99 percent of the RS_{ca}). The constituents contributing to the RS_{nc} are manganese with a relative individual noncarcinogenic risk (RS_{ni}) of 7 (70 percent of the RS_{nc}) and arsenic with an RS_{ni} of 3 (30 percent of the RS_{nc}).

There are three arsenic and one manganese concentrations in the Disturbed Area soil samples that exceeded the risk-based screening. Two of the arsenic levels [9.0 and 9.9 milligrams per kilogram (mg/kg)] that exceeded the risk-based screening are similar to site-specific background values. The arsenic concentrations and their corresponding background values are presented in Table 2-1. Thus, these concentrations are not indicative of a release.

The remaining arsenic level [64 mg/kg in DASB02(0')] that exceeded the risk-based screening is noticeably above the background value. However, the arsenic concentration in the sample collected below this surface sample [DASB02(5')] is 7.2 mg/kg. In accordance with the Final Revised Final Technical Evaluation Plan (TEP) (ESE, 1997), the relative risk value for arsenic is based on a residential scenario. The current and proposed future use of the Disturbed Area is a golf course. This future use is consistent with the Army approved Fort Sheridan Concept Plan (Concept Plan) (JJR, 1994) and with the legislation as adopted in Section 125 of the FY 1966 Military Construction Appropriations Act (P.L. 104-32). This legislation requires the Army to convey approximately 290 acres of open space and the existing golf course to the Lake County Forest Preserve District (LCFPD) for use as open space. P.L. 104-32 applies to all golf course study areas discussed below). Thus, any future exposure to arsenic at the Disturbed Area would be by construction/maintenance workers and golfers.

The arsenic level of concern is similar to the Illinois Tiered Approach to Cleanup Objectives (TACO) construction worker value of 61 mg/kg. This level of concern was detected in only one sample out of six soil samples collected in the Disturbed Area. In addition, there is no known source of release. The Disturbed Area (Hole 9 of the existing golf course) used to be Hole 6 of the original golf course. The Disturbed Area was initially identified as a study area because a review of historical aerial photographs identified an area of disturbed ground in a 1952 aerial photograph. Subsequent research into the former use of this area indicates that the original course was under construction in 1952. Thus, it appears that Hole 6 was under construction at that time.

In order to evaluate whether the arsenic level that is similar to the TACO cleanup objective protective of construction workers is also protective of recreational exposures, a risk analysis for arsenic was performed for the Disturbed Area under a recreational scenario in the Miscellaneous Study Areas DER. The results of the risk analysis indicate a potential carcinogenic risk of $3\text{E-}05$ and potential noncarcinogenic risks less than 1. Thus, the potential recreational carcinogenic risk is within U.S. Environmental Protection Agency (USEPA)'s target risk range of $1\text{E-}04$ to $1\text{E-}06$.

Only one manganese value in one sample [DASB01(11') at 1,340 mg/kg] exceeds the risk-based screening. This represents only one of six soil samples in the Disturbed Area. Although the manganese in Sample DASB01(11') exceeds its background screening value for subsurface soil, it is well below its background screening value for surface soil of 3,490 mg/kg. Support for the attribution of the manganese concentration to background can be found by reviewing the boring logs for this study area. The boring logs indicate that the till was fractured and mottled at this location. These phenomena are indicative of conditions where oxidized meteoric water moves through the till along the fractures, leaching and redepositing elements from the clay matrix. The mottling is visual evidence of the alteration areolae along the fractures. One of the elements found in clay is manganese, which is easily leached and was commonly observed in the presence of fractures as the precipitated mineral pyrolusite (MnO_2). This process results in the natural concentration of manganese.

Additionally, the criterion by which manganese exceeds the screening is not a risk-based value but a value equal to 20 times the Toxicity Characteristic Leaching Procedure (TCLP) value (20XTCLP) for the Tier 1 TACO migration to groundwater pathway. In other words, the 20XTCLP value is the Tier 1 TACO value for the migration to groundwater pathway, as determined using TCLP, multiplied by 20. This value was selected as the risk-based screening value in the Miscellaneous Study Areas DER because it is the most conservative of the three sources of screening values [Region IX Preliminary Remediation Goals (PRGs), soil screening levels (SSLs), and Illinois Environmental Protection Agency (IEPA) Tier 1 TACO values]. The 20XTCLP is a general rule of thumb used to evaluate the potential for constituents detected in the soil to leach to groundwater. Future migration to groundwater is not anticipated as this study area has been in existence for at least 40 years and the groundwater concentrations have likely reached equilibrium with the soil concentrations. Because the 20XTCLP value is not a risk-based

screening value, it is not appropriate to calculate relative individual and cumulative relative risks using the 20XTCLP value. An appropriate risk-based value for the calculation of relative risks would be the Region IX residential PRG value. For manganese, this value is 3,200 mg/kg. Using this value, the RS_m for the Disturbed Area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 64 | 2.2E+01 | 3E+00 |
| Manganese | 1,340 | 3.2E+03 | 4E-01 |
| Cumulative Risk | | | 3E+00 |

UCL = upper confidence level.

The RS_m value for manganese indicates that the concentrations of manganese at the Disturbed Area would not pose a potential unacceptable risk to human health under a residential scenario. Each of the reported manganese values in the Disturbed Area study area is also well below the TACO construction worker value of 8,700 mg/kg.

In conclusion, it appears that the Disturbed Area was an area under construction during the establishment of the original golf course. As such, there is no known source of a release at the Disturbed Area. With the exception of one soil sample, the levels of arsenic are similar to site-specific background levels. The elevated arsenic concentration is similar to the TACO cleanup objective for construction worker exposures and the risk evaluation for recreational exposures indicates there is little concern for future recreational exposures. The one value of manganese in one soil sample that exceeded the risk-based screening is within the range of background surface and subsurface soil samples. Because there is no known source for a release at the Disturbed Area, this value of manganese is likely due to background. Additionally, the value used to calculate the RS_m for manganese was 20XTCLP. The recalculated RS_m is less than 1.0.

Therefore, based on the above, it is the Base Realignment and Closure (BRAC) Cleanup Team (BCT)'s determination that the Disturbed Area does not pose an unacceptable risk to human health or to the environment and can be surplused without further environmental evaluation or remediation. Because of the elevated level of arsenic, this determination assumes the Disturbed Area will remain a golf course.

2.2 Former Trap Range Study Area

The results of the risk-based screening for the Former Trap Range are a RS_{α} of 3E-05 and no RS_m . The only constituents that contribute to the RS_{α} are polynuclear aromatic hydrocarbons (PAHs), with the principle component of the RS_{α} being benzo(a)pyrene with an RS_c of 3E-05 (86 percent of the RS_{α}).

Although benzo(a)pyrene was detected in each of the four surface soil samples, two of the four samples contained concentrations below the risk-based screening value. The risk-based screening value utilized for benzo(a)pyrene is based on a residential PRG. Because the future use of this study area is a golf course, the RS_{α} is more appropriately evaluated for future recreational and construction worker exposures.

Even under a future residential scenario, the RS_{α} is within USEPA's target risk range. Thus, an RS_{α} under a future recreational exposure scenario, with less exposure frequency and duration, would be expected to be well within the target risk range. The following results were obtained from the comparison against TACO construction worker values:

| Constituent | Sample ID | | TACO Construction Worker Value |
|------------------------|---------------|---------------|--------------------------------|
| | FTRSS01(0.5') | FTRSS02(0.5') | |
| Benzo(a)anthracene | -- | 0.71 | 170 |
| Benzo(a)pyrene | 0.95 | 1.6 | 17 |
| Benzo(b)fluoranthene | 0.84 | 1.2 | 170 |
| Indeno(1,2,3-cd)pyrene | 0.62 | 1.1 | 170 |

Note: Values in mg/kg.

Based upon the above comparison, each of the constituent concentrations exceeding the risk-based screening are well below TACO construction worker values.

Therefore, based on the above, it is the BCT's determination that the Former Trap Range does not pose an unacceptable risk to human health or to the environment and can be surplussed without further environmental evaluation or remediation.

2.3 Nike Missile Launch Control Area

The results of the risk-based screening for the Nike Missile Launch Control Area shows only one constituent (arsenic) in one soil sample [NMBSB01(2')] exceeding the risk-based screening in soil samples. The arsenic concentration resulted in an RS_{α} of $3E-05$ and an RS_{μ} less than one. This arsenic level (10 mg/kg) is similar to its site-specific background values of 7.85 mg/kg.

Therefore, it is likely that this arsenic level does not represent the effects of mission-related activities but is due to naturally occurring background. In addition, given the future use of this area as part of the golf course, this arsenic value (10 mg/kg) is more appropriately evaluated for future recreational and construction worker exposures. However, even under a future residential scenario, the RS_{α} is within USEPA's target risk range. Thus, an RS_{α} under a future recreational exposure scenario, with less exposure frequency and duration, would be expected to be well within the target risk range. The soil arsenic level is well below the TACO construction worker value of 61 mg/kg. As indicated in Section 6.0 of the Miscellaneous Study Areas DER, no groundwater constituents exceeded the risk-based screening.

Therefore, based on the above, it is the BCT's determination that the Nike Missile Launch Control Area does not pose an unacceptable risk to human health or to the environment and can be surplussed without further environmental evaluation or remediation.

2.4 Vehicle and Equipment Storage Area 1 (VES1) Study Area

The results of the risk-based screening for the VES1 Study Area are an RS_{α} of $7E-05$ and an RS_m of less than 1. Thus, only the RS_{α} exceeded the cumulative risk screening level. The principle components of the RS_{α} are arsenic with an RS_c of $3E-05$ (43 percent of the RS_{α}), benzo(a)pyrene with an RS_c of $3E-05$ (43 percent of the RS_{α}), and beryllium with an RS_c of $1E-05$ (14 percent of the RS_{α}).

There are two arsenic levels and one beryllium level that exceed the risk-based screening. The concentration of each of these inorganic constituents is compared to site-specific background values in Table 2-1. The VES1 soil sample concentrations are similar to their respective site-specific background values. Therefore, it is likely that these inorganic constituent levels do not represent the effects of mission-related activities and are due to naturally occurring or anthropogenic background. Therefore, the inorganic constituents are not considered to pose a potential concern at this study area.

In VES1, three organic constituents [benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene] in three soil samples exceed the risk-based screening. The risk-based screening values for these constituents are USEPA Region IX (August 1, 1996) PRGs for residential soil. The residential PRGs are considered appropriate because, in accordance with the approved Concept Plan, the proposed future use of VES1 is residential.

In addition, each of these samples containing PAHs at concentrations exceeding the risk-based screening was collected under asphalt. Soil collected under asphalt may be affected by organic constituents from the asphalt. Comparison of these organic constituent concentrations to the asphaltic soil baseline indicates that the PAH concentrations exceeding their respective risk-based screening values are similar to the asphaltic baseline levels.

| Constituent | Sample ID | | | Asphaltic Baseline Range | | Region IX Residential PRG |
|----------------------|--------------|----------------|--------------|--------------------------|---------|---------------------------|
| | VES1SB01(2') | VES1SB05(1.5') | VES1SS02(0') | Minimum | Maximum | |
| Benzo(a)anthracene | 0.785 | -- | 1.6 | <0.001 | 1.10 | 0.61 |
| Benzo(a)pyrene | 0.74 | 0.36k | 1.5 | <0.007 | 8.09 | 0.061 |
| Benzo(b)fluoranthene | 0.885 | -- | 1.5 | <0.001 | 1.10 | 0.61 |

Note: Values in mg/kg.

k = missed holding time for extraction and preparation.

In conclusion, because those constituents contributing to most of the 7E-05 cumulative carcinogenic risk can be attributed to background or to asphalt, these constituents are not considered to pose a potential concern in the VES1 study area. Therefore, based on the above, it is the BCT's determination that the VES1 study area does not pose unacceptable risks to human health or to the environment and can be surplussed without further environmental evaluation or remediation.

2.5 VES2 Study Area

The results of the risk-based screening for the VES2 study area are an RS_{α} of 1E-04 and an RS_{m} of 5. The principle components of the RS_{α} are benzo(a)pyrene with an RS_c of 7E-05 (51 percent of the RS_{α}), arsenic with an RS_c of 2E-05 (15 percent of the RS_{α}), and beryllium with an RS_c of 2E-05 (15 percent of the RS_{α}). Manganese accounts for 93 percent of the RS_{m} .

There are one arsenic level, eight beryllium levels, and one manganese level that exceed the risk-based screening. Each of these inorganic constituent levels is similar to their respective site-specific background values (see Table 2-1). Although the one arsenic level exceeds its respective subsurface background value, it is below its surface soil background value. The one subsurface manganese value that exceeds its respective background screening value is below its surface soil background value. Five of the six subsurface beryllium values that exceed their respective subsurface background value are below their surface soil background value. The beryllium levels detected at VES2 all fall within a narrow range of 1.01 mg/kg to 2.04 mg/kg. Background values are 1.65 mg/kg (surface) and 1.11 mg/kg (subsurface). There is no pattern suggestive of a release (e.g., a clustering of the highest values). Therefore, it is likely that the inorganic constituent levels in the VES2 soil samples do not represent effects of mission-related activities, but are due to naturally occurring or anthropogenic background.

Benzo(a)pyrene as well as benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene exceed the risk-based screening in two soil samples. These constituents were compared to USEPA Region IX PRGs for residential soil. The residential PRG is considered appropriate because, in accordance with the approved Concept Plan, the proposed future use scenario is residential. The RS_{α} is dominated by the benzo(a)pyrene level of 4 mg/kg in one sample [VES2SB01(1')]. This sample also contains the highest concentration of the other PAHs exceeding the screening. However, this sample was collected from gravel and these PAH concentrations appear to be an isolated occurrence (i.e., the PAH concentrations in the other soil samples collected at VES2 are noticeably lower). In fact, only two samples out of the nine collected at VES2 contained PAH concentrations exceeding the risk-based screening, VES2SB01(1') and VES2SB02(1.2'). In addition, Sample VES2SB02(1.2') was collected just below asphalt. Comparison of the PAH levels in this sample to the asphaltic soil baseline indicates that these PAH concentrations exceeding their respective risk-based screening values are similar to asphaltic baseline levels.

| Constituent | Sample ID VES2SB02 (1.2') | Asphaltic Baseline Range | | Risk-Based Screening Value* |
|------------------------|---------------------------------|-----------------------------|---------|-----------------------------------|
| | | Minimum | Maximum | |
| Acenaphthene | 3.83k | < 0.133 | 3.45 | 2,900† |
| Acenaphthylene | 0.386k | < 0.133 | 2.21 | 2,000 |
| Anthracene | 3.2k | < 0.007 | 5.49 | 19,000 |
| Benzo(a)anthracene | 1.6k | < 0.001 | 1.10 | 0.61 |
| Benzo(b)fluoranthene | 1.9k | < 0.001 | 1.10 | 0.61 |
| Benzo(k)fluoranthene | 0.99k | < 0.0007 | 3.74 | 6.1 |
| Benzo(g,h,i)perylene | 2.3k | < 0.007 | 1.24 | 2,000 |
| Benzo(a)pyrene | 1.8k | < 0.0007 | 8.09 | 0.061 |
| Dibenzo(a,h)anthracene | 0.7k | < 0.003 | 0.062 | 0.061 |
| Fluoranthene | 3.3k | < 0.001 | 22.2 | 2,600 |
| Fluorene | 0.391k | < 0.033 | 0.376 | 2,500 |
| Indeno(1,2,3-cd)pyrene | 1.1k | < 0.003 | 1.31 | 0.61 |
| Methylnaphthalene, 1- | 0.501k | < 0.133 | 1.68 | 2,000 |
| Methylnaphthalene, 2- | 3.75k | < 0.133 | 4.96 | 2,000 |
| Naphthalene | 2.06k | < 0.133 | 1.76 | 420† |
| Phenanthrene | 2.6k | < 0.033 | 0.830 | 2,000 |
| Pyrene | 2.6k | < 0.007 | 2.35 | 2,000 |

k = missed holding time for extraction and preparation.

Note: values in mg/kg.

* Values are Region IX residential PRGs unless otherwise noted.

† TACO Table A value.

Therefore, based on the above, the PAH concentrations detected in the VES2 surface soil are not considered to pose a potential concern in this study area.

Only one manganese value (947 mg/kg) in one sample (VES2SB02(1.2')) exceeded the risk-based screening. This represents only one of 13 soil samples collected in VES2. Although the manganese concentration in Sample VES2SB02(1.2') exceeds its background screening value for subsurface soil, it is well below its background screening value for surface soil of 3,490 mg/kg. As discussed in Section 2.1, this concentration of manganese may be due to the presence of the naturally precipitated mineral pyrolusite that was commonly observed in the fractures in the Surplus OU boring logs. Furthermore, the criterion by which manganese exceeds the screening is not a risk-based value but a value equal to 20XTCLP. An appropriate risk-based value for the calculation of relative risks would be the Region IX residential PRG value. Using this value, the RS_m for the VES2 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|---|
| Arsenic | 8.94 | 2.2E+01 | 4E-01 |
| Beryllium | 1.81* | 3.8E+02 | 5E-03 |
| Manganese | 947 | 3.2E+03 | 4E-01 |
| Cumulative Risk | | | 1E+00 |

* Value listed is the UCL for the constituent.

The resulting RS_{Σ} value is equal to 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at VES2.

In conclusion, the inorganic constituents exceeding the risk-based screening are likely due to background and the organic constituents exceeding the risk-based screening are not widespread. In addition, a recalculation of the RS_{Σ} using appropriate values indicate that no unacceptable noncarcinogenic risks are posed at this study area. Therefore, it is the BCT's determination that the VES2 study area does not pose an unacceptable risk to human health or to the environment and can be surplussed without further environmental evaluation or remediation.

2.6 Yard Area at B126

The results of the risk-based screening for the Yard Area at B126 are an RS_{Σ} of 5E-05 and an RS_{Σ} of 10. The principle components of the RS_{Σ} are arsenic with an RS_e of 4E-05 (80 percent of the RS_{Σ}) and p,p'-DDT with an RS_e of 6E-06 (8 percent of the RS_{Σ}). The principle component of the RS_{Σ} is manganese with an RS_n of 7 (70 percent of the RS_{Σ}). Cobalt also contributed to the RS_{Σ} with an RS_n of 2 (20 percent of the RS_{Σ}).

There are five arsenic, one cobalt, and two manganese levels that exceed the risk-based screening. Each of these inorganic constituents is compared to site-specific background values in Table 2-1. The inorganic constituent concentrations in B126 soil samples are similar to their respective site-specific background values. Although the two subsurface manganese values exceed their site-specific subsurface background value, the levels are well below the manganese surface background level of 3,490 mg/kg. The manganese levels exceeding the risk-based screening were in samples collected at 8 feet (1,430 mg/kg) and 2.5 feet (1,250 mg/kg). Manganese concentrations in samples collected above and below the 8-foot sample, as well as below the 2.5-foot sample, were below background values. There is no pattern to the two manganese values exceeding the risk-based screening. These concentrations of manganese may be due to the presence of the naturally precipitated mineral pyrolusite that was commonly observed in the fractures in the Surplus OU boring logs. These facts, coupled with the manganese concentrations in the samples above and/or below, indicate the two manganese values are not indicative of a release. The single cobalt level that exceeds the risk-based screening was in a sample collected at a depth of 8 feet. The samples

collected above (0 feet) and below (24 feet) contained non-detectable levels. This pattern indicates that the single cobalt level is not indicative of a release. Therefore, it is likely that these inorganic constituent levels do not represent the effects of mission-related activities and are due to naturally occurring or anthropogenic background. Also, given the depth of the single cobalt detection, there is no exposure route for this constituent (or the manganese level at 8 feet) under the future use of this study area (i.e., golf course).

The screening criteria for manganese and cobalt are not risk-based values, but rather, values equal to 20XTCLP. Appropriate risk-based values for the calculation of relative risks would be the Region IX residential PRG values. Using these values, the RS_m for the B126 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|---|
| Arsenic | 15 | 2.2E+01 | 7E-01 |
| Cobalt | 40.9 | 4.6E+03 | 9E-03 |
| DDT, p,p'- | 7.6 | 3.3E+01 | 2.0E-01 |
| Manganese | 1,430 | 3.2E+01 | 4E-01 |
| Cumulative Risk | | | 1E+00 |

The resulting RS_m value is equal to 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at B126.

In accordance with the approved Concept Plan and special legislation as described in Section 2.1, the future use of this study area is a golf course. Therefore, the RS_{cr} and RS_m are more appropriately evaluated for future recreational and construction worker scenarios. The TACO construction worker values for manganese and cobalt are 8,700 mg/kg and 12,000 mg/kg, respectively. Each of the reported cobalt and manganese values in the B126 study area is well below these values. In addition, the arsenic and p,p'-DDT values, the principle components of relative carcinogenic risk, are well below the TACO construction worker values of 61 mg/kg and 100 mg/kg, respectively. The p,p'-DDT level is also below the screening value of 130 mg/kg used in the Golf Course Report (ESE, 1996). Given that the individual relative risks for arsenic and p,p'-DDT are at the lower end of USEPA's carcinogenic target risk range under a residential scenario, the relative carcinogenic risks under a recreational scenario are likely at or below 1E-06.

Therefore, based on the above, it is the BCT's determination that the Yard Area at B126 does not pose an unacceptable risk to human health or the environment and can be surplussed without further environmental evaluation or remediation.

2.7 Yard at B216

The results of the risk-based screening for the Yard Area at B216 are an RS_{α} of 6E-05 and an RS_{π} of 9. The principle components of the RS_{α} are arsenic with an RS_c of 4E-05 (67 percent of the RS_{α}), beryllium with an RS_c of 1E-05 (13 percent of the RS_{α}), and benzo(a)pyrene with an RS_c of 8E-06 (13 percent of the RS_{α}). The principle component of the RS_{π} is manganese with an RS_{π} of 8 (93 percent of the RS_{π}).

There are two arsenic, three beryllium, and three manganese levels that exceed the risk-based screening. The concentration of each of these inorganic constituents is compared to site-specific background values in Table 2-1. As seen in the table, these inorganic constituent levels are similar to their site-specific background values. Each of the subsurface beryllium values that exceed the screening are at or below the surface background value. Each of the subsurface manganese levels is below the surface background value. Two of the three soil samples with manganese concentrations above background levels were collected from test pit B216TP1 at 4 and 8 feet, with the highest concentration present in the 4-foot sample. Both samples were collected below the concrete. The third sample was collected from soil Boring B216SB01 at 3 feet. Manganese concentrations in the samples collected above (0.5 feet) and below (13 feet) the 3-foot sample did not contain manganese concentrations above background. This distribution of manganese concentrations, along with the fact that the B216TP1 test pit was excavated beneath competent concrete, indicates these concentrations are not indicative of a release. As discussed in Section 2.1, these concentrations of manganese may be due to the presence of the naturally precipitated mineral pyrolusite that was commonly observed in the fractures in the Surplus OU boring logs. Therefore, it is likely that the inorganic constituent levels detected in B216 study area soils are not the result of mission-related activities, but are due to naturally occurring or anthropogenic background.

The criterion by which manganese exceeds the screening is not a risk-based value but a value equal to 20XTCLP. An appropriate risk-based value for the calculation of relative risks would be the Region IX residential PRG value. Using this value, the RS_{π} for the B216 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 13 | 2.2E+01 | 6E-01 |
| Beryllium | 0.999* | 3.8E+02 | 3E-03 |
| Manganese | 1,640 | 3.2E+03 | 5E-01 |
| Cumulative Risk | | | 1E+00 |

* Value listed is the UCL for the constituent.

The resulting RS_m value is equal to 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at B216.

Only one benzo(a)pyrene concentration in eight samples exceeded the risk-based screening. Benzo(a)pyrene was the only detected in four of the eight samples. Thus, it appears that this one detection above the risk-based screening level is an isolated occurrence and that the four out of eight detection indicate that benzo(a)pyrene is not widely distributed in the soils at B216.

The RS_{α} and recalculated RS_m for B216 are based on a residential scenario. These values are well within or at USEPA's target risk range. The inorganic constituents exceeding the risk-based screen appear to be present at B216 due to background and the one dibenzo(a,h)anthracene detection appears to be an isolated occurrence. Therefore, it is the BCT's determination that the Yard Area at B216 does not pose an unacceptable risk to human health or to the environment and can be surplused without further environmental evaluation or remediation.

2.8 B42 Study Area

The results of the risk-based screening for the B42 study area are an RS_{α} of $5E-04$ and an RS_m of 4. The principle components of the RS_{α} are benzo(a)pyrene with an RS_c of $3E-04$ (70 percent of the RS_{α}) and benzo(a)anthracene with an RS_c of $5E-05$ (12 percent of the RS_{α}). The principle component of the RS_m is manganese with an RS_n of 4 (basically 100 percent of the RS_m).

The one subsurface manganese value (918 mg/kg) that exceeds the risk-based screening is above the subsurface background value but considerably below the surface soil background value of 3,490 mg/kg. This is the only sample out of a total of eight samples with a manganese level exceeding background. Thus, the sample collected above this one sample did not contain a manganese level above background. This pattern indicates that the single manganese level is not indicative of a release and is an isolated occurrence. In addition, as discussed in Section 2.1, this concentration of manganese may be due to the presence of the naturally precipitated mineral pyrolusite that was commonly observed in the fractures in the Surplus OU boring logs. Therefore, this concentration does not appear to represent the effects of mission-related activities but is likely due to naturally occurring background.

In addition, the screening criterion that manganese exceeds is not a risk-based value but a value equal to 20XTCLP. An appropriate risk-based value for the calculation of relative risks would be the Region IX residential PRG value. Using this value, the RS_m for the B42 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 8.91 | 2.2E+01 | 4E-01 |
| Beryllium | 1.12* | 3.8E+02 | 3E-03 |
| Manganese | 783.7* | 3.2E+03 | 2E-01 |
| Cumulative Risk | | | 1E+00 |

* Value listed is the UCL for the constituent.

The resulting RS_m value is equal to 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at B42

The RS_{α} for B42 is based on residential risk-based screening values, which, in accordance with the approved Concept Plan, are appropriate for the future use of this study area. Because the RS_{α} is 5 times the upper end of USEPA's target risk range (1E-04) and because these constituents are present as a result of mission related activities related to coal storage, a removal action is recommended for this study area. The organic constituents [PAHs including benzo(a)pyrene] that exceeded the risk-based screening appear to be limited to surface soils.

2.9 B43 Study Area

The results of the risk-based screening for the B43 study area are an RS_{α} of 2E-04 and an RS_m of 8. The principle components of the RS_{α} are benzo(a)pyrene with an RS_c of 1E-04 (53 percent of the RS_{α}) and dibenzo(a,h)anthracene with an RS_c of 3E-05 (16 percent of the RS_{α}). The principle component of the RS_m is manganese with an RS_n of 8 (basically 100 percent of the RS_m).

The one subsurface manganese value (1,020 mg/kg) that exceeded the screening was above the subsurface background value but considerably below the surface soil background value of 3,490 mg/kg. The sample collected above, as well as the other 18 soil samples, did not contain manganese concentrations above background levels. This pattern indicates that the single manganese level is not indicative of a release. As discussed in Section 2.1, this concentration of manganese may be due to the presence of the naturally precipitated mineral pyrolusite that was commonly observed in the fractures in the Surplus OU boring logs. Therefore, this concentration does not represent the effects of mission-related activities but is likely due to naturally occurring background.

The screening criterion that manganese exceeds is not a risk-based value but a value equal to 20XTCLP. An appropriate risk-based value for the calculation of relative risks would be the Region IX residential PRG value. Using this value, the RS_m for the B43 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 7.34* | 2.2E+01 | 3E+01 |
| Beryllium | 0.743* | 3.8E+02 | 2E-03 |
| Manganese | 1,550 | 3.2E+03 | 5E-01 |
| Cumulative Risk | | | 1E+00 |

* Value listed is the UCL for the constituent.

The resulting RS_m value is equal to 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at B43.

The RS_α for B43 is based on residential risk-based screening values, which are appropriate for the future use of this study area. Because the RS_α is 2 times the upper end of USEPA's target risk range (1E-04), and because these constituents are present as a result of mission related activities related to coal storage, a removal action is recommended for this study area. The organic constituents [PAHs including benzo(a)pyrene] that exceeded the risk-based screening appear to be limited to surface soils.

2.10 B57A, B57C, and Former B57B Study Area

Results of the risk-based screening for the B57A, B57C, and Former B57B study area are an RS_α of 1E-05. There is no RS_m associated with this study area. Only three PAHs [benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene] are identified as exceeding the risk-based screening. The principle component of the RS_α is benzo(a)pyrene with an RS_c of 1E-05 or 83 percent of the RS_m . The PAH concentrations in B57A, B57B, and B57C soil samples were compared to USEPA Region IX PRGs for residential soil. This comparison is considered appropriate because, in accordance with the approved Concept Plan, the intended land use for this study area is residential. The affected soil is limited to the upper 0.5 foot. The RS_α for this study area is 1E-05, which is well within USEPA's target carcinogenic risk range. Therefore, based on the above, it is the BCT's determination that the B57A, B57C, and Former B57B study area does not pose an unacceptable risk to human health or the environment and can be surplussed without further environmental evaluation or remediation.

2.11 B77 Study Area

Results of the risk-based screening for the B77 study area are an RS_α of 4E-04 and an RS_m of 8. The principle components of the RS_α are arsenic with an RS_c of 2E-04 (50 percent of the RS_α) and benzo(a)pyrene with an RS_c of 1E-04 (25 percent of the RS_α). The principle components of the RS_m are arsenic with an RS_n of 3 (38 percent of the RS_m), selenium with an RS_n of 3 (38 percent of the RS_m), and lead with an RS_n of 2 (25 percent of the RS_m).

The one arsenic, one selenium, and two lead concentrations exceeding the screening are one order of magnitude higher than their corresponding site-specific background values (see Table 2-1).

The organic constituents exceeding the risk-based screening are benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene. These constituents were compared to residential PRGs in the risk based screening. This comparison is appropriate because, in accordance with the approved Concept Plan, the intended use for the B77 study area is residential. Because the RS_{α} and RS_{Σ} are 4 and 8 times the target carcinogenic and noncarcinogenic risk values, respectively, and because mission activities (incineration, battery storage and retrofitting) are likely the source of these constituents, the inorganic and organic constituents identified above are considered to pose a potential concern in this area. Therefore, a removal action is recommended to address these constituent concentrations. The analytical data indicate that affected soil is limited to surface soils.

2.12 B86 Study Area

The results of the risk-based screening for the B86 study area are an RS_{α} of 5E-05 and an RS_{Σ} of 5. The principle components of the RS_{α} are arsenic with an RS_c of 3E-05 (58 percent of the RS_{α}) and beryllium with an RS_c of 2E-05 (38 percent of the RS_{α}). The principle component of the RS_{Σ} is manganese with an RS_a of 5 (basically 100 percent of the RS_{Σ}).

There are two arsenic, two beryllium, and one manganese levels that exceed the risk-based screening. The concentration for each these inorganic constituents is compared to background values in Table 2-1. Each of these levels is similar to their respective site-specific background values. Therefore, it is likely the inorganic constituent levels in B86 soil samples are not related to mission activities, but are due to naturally occurring or anthropogenic background.

In addition, because the 20XTCLP value used for manganese is not a risk-based screening value, it is not appropriate to calculate relative individual and cumulative relative risks using the 20XTCLP value. An appropriate risk-based value for the calculation of relative risks would be the Region IX residential PRG value. Using this value, the RS_{Σ} for the B86 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 12 | 2.2E+01 | 5E-01 |
| Beryllium | 1.46 | 3.8E+02 | 4.E-03 |
| Manganese | 951.1* | 3.2E+03 | 3E-01 |
| Cumulative Risk | | | 1E+00 |

* Value listed is the UCL for the constituent.

The resulting RS_{nt} value is equal to 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at B86.

Therefore, it is the BCT's determination that these inorganic constituents do not pose an unacceptable risk to human health or to the environment and this study area can be surplussed without further environmental evaluation or remediation.

2.13 B117 Study Area

The results of the risk-based screening for the B117 study area are an RS_{ct} of $2\text{E-}06$ with no RS_{nt} . The principle component of the RS_{ct} is benzo(a)pyrene with an RS_{c} of $2\text{E-}06$ (83 percent of the RS_{ct}). Only organic constituents in the B117 study area exceed the risk-based screening.

In accordance with the approved Concept Plan and with the special legislation (see discussion under the Disturbed Area), the future use of this study area is a golf course, the RS_{ct} is more appropriately evaluated for future recreational and construction worker scenarios. Given that the RS_{ct} of $2\text{E-}06$ is well within USEPA's target risk range under a residential scenario, the relative risks under a recreational scenario are likely at or below $1\text{E-}06$.

To further evaluate the potential effects of the benzo(a)pyrene and dibenzo(a,h)anthracene under the future use scenario for the B117 study area, the constituent concentrations are compared to the appropriate TACO construction worker values. The following presents this comparison:

| Constituent | Sample ID B117SD01 | TACO Construction Worker Values |
|------------------------|-----------------------|------------------------------------|
| Benzo(a)pyrene | 0.25 | 17 |
| Dibenzo(a,h)anthracene | 0.094 | 17 |

As shown above, the constituent concentrations are well below the TACO construction worker values. Therefore, based on the above, it is the BCT's determination that the constituent concentrations at the B117 study area do not pose an unacceptable risk to human health or to the environment and this study area can be surplussed without further environmental evaluation or remediation.

2.14 Former B127 Study Area

The results of the risk-based screening for the Former B127 study area are an RS_{ct} of $4\text{E-}05$ with no associated RS_{nt} . The principle component of the RS_{ct} is benzo(a)pyrene with an RS_{c} of $3\text{E-}05$ (77 percent of the RS_{ct}).

The samples collected at B127 are within Bartlett Ravine. Therefore, although the area near Bartlett Ravine will be used for residential housing in the future in accordance with the approved Concept Plan, the actual exposure scenario for the Former B127 study area is recreational. Thus, the RS_{α} is more appropriately evaluated for future recreational and construction worker exposure. The RS_{α} of $4E-05$ for future residential use is within USEPA's target risk range. Due to less exposure duration and frequency under both a recreational and construction worker scenario, the relative risks would be lower. In fact, the TACO construction worker value of 17 mg/kg is well above the detected concentration of 2 mg/kg. Therefore, it is the BCT's determination that the constituents concentrations at the Former B127 study area do not pose an unacceptable risk to human health and this study area can be surplussed without further environmental evaluation or remediation.

2.15 B135 Study Area

The results of the risk-based screening for the B135 study area are an RS_{α} of $7E-05$ and an RS_{α} of less than one. The principle components of the RS_{α} are benzo(a)pyrene with an RS_e of $3E-05$ (45 percent of the RS_{α}) and arsenic with an RS_e of $2E-05$ (30 percent of the RS_{α}).

The arsenic level in the one B135 soil sample that exceeds the risk-based screening is similar to its site-specific background value (see Table 2-1). Thus, this concentration is not indicative of a release due to mission-related activities, but rather due to anthropogenic or naturally occurring background.

Only the two surface soil samples contained benzo(a)pyrene concentrations above the risk-based screening value. In both soil borings, the next deeper interval samples (2.5 and 3 feet) did not contain detectable levels of benzo(a)pyrene. The deepest sample intervals (8.5 and 9.5 feet) contained levels below the risk-based screening value. The highest detections of benzo(a)pyrene correlate with the presence of coal noted in the boring log, with coal fragments only noted at the surface. Thus, this pattern indicates that benzo(a)pyrene levels above risk-based screening levels are confined to a thin veneer at the surface and not widespread throughout the soil column.

Assuming future residential reuse, the estimated carcinogenic risk is within USEPA's target risk range. Arsenic, which makes up 30 percent of the estimated risk, is at background levels. Therefore, it is the BCT's determination that the B135 study area does not pose an unacceptable risk to human health or to the environment and can be surplussed without further environmental evaluation or remediation.

2.16 B172 Study Area

Results of the risk-based screening for the B172 study area are that only polychlorinated biphenyl (PCB) 1248 exceeds the risk-based screening at 15 mg/kg in Sample B172SS01(0'). The RS_{α} value is $2E-04$ and the RS_m is 10. The PCB level (15 mg/kg) is above the 10 mg/kg standard set forth in 40 Code of Federal Regulation (CFR) 761.125(c)(4)(v) for unrestricted use. The risk-based screening value used to calculate the $2E-04$ carcinogenic risk value is based on a residential exposure, and B172 is part of the golf course. Given a reduced individual exposure under a recreational scenario, the estimated carcinogenic risks are likely to be less. However, USEPA indicates that for sites where the cumulative site risk to an individual is less than $1E-04$, remedial action may be warranted if a chemical specific standard that defines acceptable risk is exceeded. Because only one sample was collected from the area where the PCB was detected (thus, the extent of the PCBs present is unknown), additional sampling and/or a removal action is recommended for this study area.

2.17 B911 Study Area

The results of the risk-based screening for the B911 study area are an RS_{α} of $4E-05$ and an RS_m of 2. The principle components of the RS_{α} are arsenic with an RS_c of $3E-05$ (58 percent of the RS_{α}) and beryllium with an RS_c of $2E-05$ (38 percent of the RS_{α}). The principle component of the RS_m is cobalt with an RS_n of 1 (71 percent of the RS_m).

There are two arsenic, one beryllium, and one cobalt levels that exceed the risk-based screening. The concentration for each of these constituents is compared to site-specific background values in Table 2-1. Each of these constituent levels, with the possible exception of cobalt, is similar to its site-specific background level. Therefore, it is likely that these inorganic constituent levels in B911 soil samples are not related to mission activities and are due to naturally occurring or anthropogenic background.

The one cobalt level (24.7 mg/kg) that exceeds the risk-based screening is above its background value of 16.3 mg/kg. However, only one cobalt level in five samples exceeds the screening. The cobalt level in the sample collected in the interval above, 3.89 mg/kg, is far below the background value. This pattern, as well as the fact that there is no known source for the cobalt indicates this concentration is not the result of a release. In addition, because the 20XTCLP value used for cobalt is not a risk-based screening value, it is not appropriate to calculate relative individual and cumulative relative risks using the 20XTCLP value. An appropriate risk-based value for the calculation of relative risks would be the Region IX residential PRG value. Using this value, the RS_m for the B911 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 9.8 | 2.2E+01 | 4E-01 |
| Beryllium | 1.64 | 3.8E+02 | 4E-03 |
| Cobalt | 24.7 | 4.6E+03 | 5E-03 |
| Cumulative Risk | | | 4E-01 |

The resulting RS_m value is less than 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at B911.

Furthermore, the future use of the B911 study area is as part of the golf course in accordance with the approved Concept Plan. Each of the B911 study area cobalt levels is well below the TACO construction worker value of 12,000 mg/kg.

In addition, the screening criterion that cobalt exceeds is not a risk-based value but a value equal to 20XTCLP. However, cobalt concentrations in background and Surplus OU groundwater samples do not exceed the risk-based screening value for cobalt in groundwater [35 Illinois Administrative Code (IAC) Part 620]. Thus, the 20XTCLP value for cobalt is an overly conservative screening values for Fort Sheridan.

Therefore, based on the above, it is the BCT's determination that the B911 study area does not pose an unacceptable risk to human health or the environment and can be surplussed without further environmental evaluation or remediation.

2.18 Coal Storage Area 1 (CSA1) Study Area

The results of the risk-based screening for the CSA1 study area are an RS_α of 1E-04 and an RS_m of 9. The principle components of the RS_α are arsenic with an RS_c of 7E-05 (54 percent of the RS_α) and beryllium with an RS_c of 5E-05 (38 percent of the RS_α). The principle components of the RS_m are manganese with an RS_n of 6 (65 percent of the RS_m), cobalt with an RS_n of 2 (22 percent of the RS_m), and arsenic with an RS_n of 1 (11 percent of the RS_m).

There are 23 arsenic, 3 beryllium, 1 cobalt, and 1 manganese levels that exceed the risk-based screening. Each of these inorganic constituents is compared to site-specific background values in Table 2-1. Several of the inorganic constituent concentrations are noticeably higher than their respective background values. However, of the 40 samples collected, arsenic was dissimilar to background in only four samples (14 mg/kg to 28 mg/kg) and beryllium was dissimilar to background values in only one sample (5.1 mg/kg). As discussed in Section 2.1, the single concentration of manganese exceeding the risk-based screening may be due to the presence of the

naturally precipitated mineral pyrolusite that was commonly observed in the fractures in the Surplus OU boring logs.

The criteria by which manganese and cobalt exceed the screening are not risk-based values but values equal to 20XTCLP. An appropriate risk-based values for the calculation of relative risks would be the Region IX residential PRG values. Using these values, the RS_m for the CSA1 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 28 | 2.2E+01 | 1E+00 |
| Beryllium | 5.11 | 3.8E+02 | 1E-02 |
| Cobalt | 31.9 | 4.6E+03 | 7E-03 |
| Manganese | 1,270 | 3.2E+03 | 4E-01 |
| Cumulative Risk | | | 1E+00 |

The resulting RS_m value is equal to 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at CSA1. Such a scenario is considered appropriate because the proposed future use scenario for the Surplus OU portion of this study area is residential.

As shown above, the cumulative carcinogenic relative risk value is driven by inorganics. The only known source material of concern for these inorganics is the widespread coal. The inorganic exceedences of the risk-based screening values discussed above are not indicative of a widespread pattern of elevated arsenic and beryllium values and are, therefore, not likely due to the presence of the coal. Thus, it is the BCT's determination that the CSA1 study area does not pose an unacceptable risk to human health or the environment and can be surplussed without further environmental evaluation or remediation.

2.19 CSA2 Study Area

The results of the risk-based screening for the CSA2 study area are an RS_c of 1E-04 and an RS_m of 20. The principle components of the RS_c are arsenic with an RS_c of 5E-05 (42 percent of the RS_c) and benzo(a)pyrene with an RS_c of 4E-05 (33 percent of the RS_c). The principle component of the RS_m is manganese with an RS_m of 20 (basically 100 percent of the RS_m).

There are seven arsenic and three manganese levels that exceed the risk-based screening. Each of these inorganic constituents is compared to site-specific background values in Table 2-1. Each of the inorganic constituent concentrations, with the exception of arsenic, is similar to their respective background values. Only 3 of 23 soil samples analyzed for arsenic contain arsenic concentrations

dissimilar to background (17 mg/kg, 18 mg/kg, and 19 mg/kg). In each instance, except for the 19 mg/kg detection from a surface sample location only, the next deeper sample interval did not contain arsenic above background levels.

The manganese levels that exceed the risk-based screening are from subsurface samples. The manganese levels in each of these subsurface samples is below the surface background value of 3,490 mg/kg. As discussed in Section 2.1, these concentrations of manganese may be due to the presence of the naturally precipitated mineral pyrolusite that was commonly observed in the fractures in the Surplus OU boring logs. As with arsenic, these concentrations represent only 3 of the 23 samples collected. Also, in each instance (the 1,170 mg/kg detection is from a single sample interval), the sample collected from the interval above or below these samples are below the background value.

As with CSA1, the source material of concern is coal. The exceedences discussed above are not indicative of a widespread pattern of elevated arsenic and manganese values and are, therefore, not likely due to the presence of the coal. No other source for these inorganics is known (arsenic and manganese exceedences of background only occur in CSA2 samples, not B40 samples).

In addition, the screening criterion that manganese exceeds is not a risk-based value but a value equal to 20XTCLP. An appropriate risk-based value for the calculation of relative risks would be the Region IX residential PRG value. Using this value, the RS_m for the CSA2 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 19 | 2.2E+01 | 9E-01 |
| Beryllium | 1.63 | 3.8E+02 | 4E-03 |
| Manganese | 3,090 | 3.2E+03 | 1E+00 |
| Cumulative Risk | | | 2E+00 |

The resulting RS_m value is 2.0, an order of magnitude lower than the RS_m calculated using the 20XTCLP value for manganese. This value is an indication that a potential unacceptable noncarcinogenic risk may exist under a residential scenario at CSA2. Such a scenario is considered appropriate because the proposed future use scenario for this study area is residential.

Although the cumulative relative carcinogenic risk is at the upper end of USEPA's target risk range and the cumulative noncarcinogenic relative risk is greater than 1, the risks are primarily due to inorganic constituents present at the study area due to background and not the presence of coal. The value of benzo(a)pyrene (2.1 mg/kg) in CSA2SS01(0') accounting for a third of the RS_{ca}

is an isolated concentration (one out of 15 samples). All other detections are less than 1 mg/kg. Therefore, given the above, it is the BCT's determination that the CSA2 study area does not pose an unacceptable risk to human health or to the environment and can be surplussed without further environmental evaluation or remediation.

2.20 CSA3 Study Area

The results of the risk-based screening for the CSA3 study area are an RS_{c} of 2E-04 and an RS_{m} of 9. The principle components of the RS_{c} are benzo(a)pyrene with an RS_{c} of 1E-04 (53 percent of the RS_{c}), dibenzo(a,h)anthracene with an RS_{c} of 3E-05 (16 percent of the RS_{c}), and arsenic with an RS_{c} of 2E-05 (10 percent of the RS_{c}). The principle component of the RS_{m} is manganese with an RS_{m} of 9 (97 percent of the RS_{m}).

There are five arsenic and three manganese levels that exceed the risk-based screening. These inorganic constituent concentrations are compared to site-specific background values in Table 2-1. Each of the inorganic constituent levels is similar to their respective background levels. In addition, the manganese levels that exceed the screening are limited to subsurface samples. Each of these subsurface manganese levels are below the surface background level of 3,490 mg/kg. In each instance (the 964 detection is from a single sample interval), the sample collected from the next interval below the samples containing these levels did not contain concentrations above background. As with the other CSAs, the source material of concern is coal. These exceedences, out of a total of 24 samples, are not indicative of a widespread pattern of arsenic and manganese values and are, therefore, not likely due to the presence of coal. As discussed in Section 2.1, the concentrations of manganese may be due to the presence of the naturally precipitated mineral pyrolusite that was commonly observed in the fractures in the Surplus OU boring logs. Thus, these concentrations are not indicative of a release and not of concern.

It is also noted that the screening criterion that manganese exceeds is not a risk-based value but a value equal to 20XTCLP. An appropriate risk-based value for the calculation of the relative risk for manganese would be the Region IX residential PRG value. Using this value, the RS_{m} for the CSA3 study area is recalculated as follows:

| Constituent | UCL or Maximum Concentration Detected (mg/kg) | Noncarcinogenic Screening Value (mg/kg) | Relative Individual Noncarcinogenic Risk |
|-----------------|---|---|--|
| Arsenic | 11 | 2.2E+01 | 5E-01 |
| Manganese | 1,720 | 3.2E+03 | 5E-01 |
| Cumulative Risk | | | 1E+00 |

The resulting RS_{m} value is equal to 1.0, indicating that no potential unacceptable noncarcinogenic risks would be posed to human health under a residential scenario at CSA3.

Although the inorganic constituent concentrations are not of concern, the organic constituent concentrations, especially benzo(a)pyrene, are of concern at two times the upper end of USEPA's target carcinogenic risk range ($1E-04$). With the exception of the benzo(a)pyrene and dibenzo(a,h)anthracene levels in Sample CSA3SB05(7'), the concentrations of these two constituents exceeding the risk-based screening are confined to the upper 2 feet and scattered throughout the study area. Because this study area is slated for future residential use in accordance with the approved Concept Plan, a removal action is recommended for the CSA3 study area.

2.21 Unexploded Ordnance (UXO) Study Area

The results of the risk-based screening for the UXO study area are an RS_{α} of $3E-05$ and an RS_{α} below 1. The principle component of the RS_{α} is arsenic with an RS_c of $3E-05$ (94 percent of the RS_{α}). The concentrations of arsenic are similar to its site-specific background values. Therefore, it is likely that these arsenic levels are not the result of mission-related activities and are due to naturally occurring or anthropogenic background. Therefore, the arsenic levels are not considered to pose a potential concern in this study area.

In accordance with the approved Concept Plan, the UXO study area will become part of the golf course. Thus, the RS_{α} is more appropriately evaluated for future recreational and construction worker exposures. The RS_{α} of $3E-05$ for future residential use is within USEPA's target carcinogenic risk range. Due to less exposure duration and frequency under both a future recreational and construction worker scenario, the relative risks would be lower. In fact, the TACO construction worker value for arsenic of 61 mg/kg is well above the maximum detected concentration of 10.8 mg/kg.

Therefore, given the above, it is the BCT's determination that the UXO study area does not pose an unacceptable risk to human health or the environment and can be surplussed without further environmental evaluation or remediation.

Table 2-1. Comparison of Select Inorganic Constituent Concentrations (mg/kg) in Soil with Background Data (Page 1 of 2)

| Constituent | Soil Group | Concentration Exceeding Screening | Fort Sheridan Background |
|--------------------------|------------|-------------------------------------|--------------------------|
| Disturbed Area | | | |
| Arsenic | Surface | 9.0, 64 | 8.96 |
| | Subsurface | 9.9 | 7.85 |
| Manganese | Subsurface | 1,340 | 896 |
| VES1 Study Area | | | |
| Arsenic | Subsurface | 8.5, 11.1* | 7.85 |
| Beryllium | Subsurface | 1.15 | 1.11 |
| VES2 Study Area | | | |
| Arsenic | Subsurface | 8.55 | 7.85 |
| Beryllium | Surface | 1.94, 2.04 | 1.65 |
| | Subsurface | 1.45, 1.16, 1.72, 1.34*, 1.32, 1.23 | 1.11 |
| Manganese | Subsurface | 947 | 896 |
| Yard Area at B126 | | | |
| Arsenic | Surface | 10.7 | 8.96 |
| | Subsurface | 15, 8.09, 11, 10.6 | 7.85 |
| Cobalt | Subsurface | 40.9 | 16.27 |
| Manganese | Subsurface | 1430, 1250 | 896 |
| Yard Area at B216 | | | |
| Arsenic | Subsurface | 13, 8.48 | 7.85 |
| Beryllium | Subsurface | 1.21, 1.65, 1.2 | 1.11 |
| Manganese | Subsurface | 1640, 1570, 980 | 896 |
| B42 Study Area | | | |
| Manganese | Subsurface | 918 | 896 |
| B43 Study Area | | | |
| Manganese | Subsurface | 1020 | 896 |
| B77 Study Area | | | |
| Arsenic | Surface | 65 | 8.96 |
| Lead | Surface | 570, 679 | 56.7 |
| Selenium | Surface | 3.38 | 1.5 |

Table 2-1. Comparison of Select Inorganic Constituent Concentrations (mg/kg) in Soil with Background Data (Page 2 of 2)

| Constituent | Soil Group | Concentration Exceeding Screening | Fort Sheridan Background |
|------------------------|------------|--|--------------------------|
| B86 Study Area | | | |
| Arsenic | Subsurface | 12, 9.49 | 7.85 |
| Beryllium | Subsurface | 1.32, 1.14 | 1.11 |
| Manganese | Subsurface | 986 | 896 |
| B135 Study Area | | | |
| Arsenic | Subsurface | 9.1 | 7.85 |
| B911 Study Area | | | |
| Arsenic | Subsurface | 9.8, 9.6 | 7.85 |
| Beryllium | Subsurface | 1.64 | 1.11 |
| Cobalt | Subsurface | 24.7 | 16.27 |
| CSA1 Study Area | | | |
| Arsenic | Surface | 9.3, 9 | 8.96 |
| | Subsurface | 9.4, 8.82, 9.1, 9.59, 9.8, 9.27, 10.8, 9.48, 8.39, 15, 8.06, 14, 8.78, 8.82, 16, 10, 8.7, 28, 12 | 7.85 |
| Beryllium | Subsurface | 5.11, 1.4, 1.36 | 1.11 |
| Cobalt | Subsurface | 31.9 | 16.27 |
| Manganese | Subsurface | 975 | 896 |
| CSA2 Study Area | | | |
| Arsenic | Surface | 19 | 8.96 |
| | Subsurface | 11, 17, 10.49, 18, 8.86, 8.88 | 7.85 |
| Manganese | Subsurface | 1170, 2450, 3090 | 896 |
| CSA3 Study Area | | | |
| Arsenic | Subsurface | 8.35, 10.8, 11, 8.1, 9.2 | 7.85 |
| Manganese | Subsurface | 964, 1070, 1720 | 896 |
| UXO Study Area | | | |
| Arsenic | Surface | 10.8, 9.45 | 8.96 |

* Average of duplicate samples.